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The Mather Electric Company.

DESCRIPTION OF THE MATHER-PERKINS INCANDESCENT SYSTEM, WITH ILLUSTRATIONS OF THE DYNAMO AND LAMPS.

The Mather Electric Company, of Hartford, Conn., owning the Mather-Perkins incandescent system, is an organization thoroughly equipped with electrical, mechanical and commercial advantages for securing an abundant hearing from the electric-lighting public. The work of this company in the past, even before the valuable improvements which we chronicle had been made, was such as to give it honorable standing in this field. In Chicago, where one of the leading opera houses has been fitted up with the lamps and dynamos of this system, the beauties of the light are highly praised, the audience heartily applauding the appearance of the light the night it supplanted the unhealthy and unsatisfactory gas. The Mather Company is well established, with a complete factory in Hartford capable of carrying on extensive work, and the class of the work done is shown in the universal satisfaction with which it is greeted wherever the system is known or has been tried.

We shall endeavor in this article to give the readers of the REVIEW a description of the Mather-Perkins incandescent system, presenting the various points of interest as they appear to us, and stating the claims made by the owners.

In Fig. 1, on this page, is shown the Mather dynamo. The illustration gives an excellent idea of the appearance of this machine, which has a fine reputation among dealers and patrons.

Fig. 2 is an accurate representation of the field magnet employed in this system. Its shape is peculiar, being that of a broken, yet true, ring. It may be termed a scientific idea realized in one solid piece of cast iron. There are no joints or breaks, no abrupt corners, nothing to offer obstruction. There are no pole-pieces to bring the arms of the magnet near the armature. The projecting portions at the ends of the arms serve only as a base for the dynamo, and are not an essential electrical feature of the magnet. The smaller projections above the base are merely mechanical details intended to form a guard in holding the wires wrapped round the magnet in place. A glance at the machine will show that these projections do not appear in the finished machine. Another feature of the magnet may be observed in the position of the ends of the magnet in relation to the armature which fills the space between them. These ends are in the center of the magnetic field, directly opposite the center of the armature. Its shape admits of the greatest mass in the least space, which is an advantage. The poles of the magnet are integral parts of the magnet, and their position is the best for securing good electrical results. The shape of the magnet admits of unbroken lines of wire covering every part. The armature occupies a place between the ends of the magnet—a position best adapted to obtain good results.

The openings in the ends of the magnets are for the supports of the armature, and, like the ring in the top of the magnet, are purely mechanical in design, and do not in any essential particular affect the electrical esults obtained from the machine. The ring form of this magnet gives to the dynamo a graceful shape, and, while beauty of form may not in a machine prove of much commercial value, yet it must be recognized that beauty of form is an evidence of correctness of design. The magnet, when finished, is carefully wrapped with cloth to insure insulation, and, after being wound with insulated copper wire, is wrapped with tape, varnished with asphaltum, giving the machine a neat, clean and durable cover, designed to protect it against all injury.

FIG. 1.—MATHER DYNAMO.

Much depends on the construction of the armature, and modern inventors have brought out a number of types or typical forms of armatures. Among the best of these is the Siemens, and this armature, greatly modified and improved, has been selected for the Mather Dynamo, shown in Fig. 15. The armature differs from the original type in the form of the core and the system of winding, and it is believed to be decidedly superior to it in several respects. The commutator and brushes have been made the subject of much careful thought, and it may be said with confidence that they are among the best in use, drawing off the current without sparks or sounds. This silence and absence of sparking tends to prevent wearing away of the commutators, and economizes power and electricity, and is a very satisfactory result of the work of the electricians of this company.

One of the first difficulties met with in the introduction of the incandescent light sprang from the fact that if a large number of lamps were supplied with electricity from a single machine, there was a disagreeable variation in the power of the lamps every time a greater or less number of lamps were turned on or extinguished. A number of appliances have been used in different systems to obviate this, all of them having been more or less successful. These "regulators" are quite independent of the dynamos, and of necessity add to the cost of the electric-lighting plant where they are used. The Mather dynamo is operated without any external regulator. It is self-contained. By the superior manner in which it is constructed all the regulation required under changes in the number of lamps in a circuit is automatic, complete in effect and instantaneous in operation. This power of self-regulation saves the cost of a supplementary regulator, reduces the cost of plant and maintenance and adds greatly to the electrical value of the system.

Summed up, the electrical value of the Mather machine is found in the form of magnet, an improved armature of a first class type, absence of sparking at the commutator and automatic regulation.

In speaking of the mechanical advantages of the Mather-Perkins system, it is well to state that it is quite possible that a dynamo may be an excellent electrical generator and yet be so awkward in design or so inconvenient in shape that there will be difficulty in finding a suitable place for it and keeping it in operation. Mere inconvenience in shape can be overlooked, if the other qualities of the machine are desirable, but the moment we have to consider any machine, however efficient or useful, we are obliged to examine it simply as a machine. A dynamo is a machine precisely as a loom or a lathe is a machine. Moreover, it is a high-speed machine, and this means it is an instrument of precision. There must be firmness and solidity to ensure steadiness of speed, good design, good material and good workmanship to prevent friction, irregularity of running, and waste of power. These points are found embraced in the Mather Dynamo. Materials and construction are matters of business economy, because only the best is in any sense economical. The Mather Electric Company is fully alive to the value of this view of the matter. An examination of the dynamo will show that the mechanical design of the machine is quite new. The armature is supported in the magnet by a journal in a yoke at each side of the magnet; these yokes that form the bearings for the journals are directly supported by the magnet. Practically, the entire machine is self-contained. The magnet supports every part of the machine, and can be run at full speed, supported only by the ring at the top of the magnet. While this would not be the best way, it is a possible way, and happily illustrates the admirable design of the machine.

In Fig. 2 will be seen two holes cast in the magnet. These are somewhat larger in diameter in the interior of the casting, and when the machine is to be built up, these holes are bored out true at each end and finished alike. In these openings are placed the two steel rods that form the "cradle" or support for running parts of the machine. This method of finding a support for these parts has several advantages. The mass of the magnet is so great that the two rods can never get out of line. The rods will be exactly parallel at all times and will preserve the armature in a true and fixed position at all times. This arrangement makes it impossible that the various parts shall get out of line in transportation and in setting up. The relations of the parts must always be the same whatever the position of the magnet. It is not even necessary that it should stand level or in any particular position. Aside from the inconvenience, the machine, it is stated, will work just as well on its side or upside down as in any other position. All trouble in setting up is there-

fore avoided, the finished machine being ready for work as soon as placed upon its pedestal, or on any steady base. The construction, design and materials of the yoke have been also made the subject of much thought, and taken as a whole, the dynamo is a fine piece of mechanism. The alignment of the parts, the wear of the bearings and the running of the machine are believed to result in the highest mechanical efficiency. Lastly, the shape of the machine is intended to give the best results in the least space. The circular shape of the magnet makes it possible to place the machine in positions where "head room" or space is valuable. The self-contained design of the parts makes it possible to easily move and set up the machine and also economizes floor space.

The dynamo is firmly fastened to a wooden base, and this may be placed upon a cast-iron pedestal to bring the parts to a convenient height. The pedestal is provided with a screw for sliding the dynamo forward and backward to assist in tightening the belt. Whether regarded as an electrical generator or as a high-speed machine, this dynamo clearly merits the praise it has received, and its design is both electrically and mechanically of the best.

In speaking of the incandescent lamps of the Mather-Perkins system, it is well to remember that there are five requisites in first-class incandescent lamps: 1. They must give an abundance of light, or be of high candle-power. 2. They must be of clear glass and free from discoloration. 3. They must be durable, or capable of burning a long time. 4. They must economize the electricity; in other words, have such a construction that each lamp will give the greatest amount of light for the least expenditure of power in the dynamo. 5. They should be capable of regulation so that one lamp will give much or little light as may be desired.

It is believed that the lamps used in this system fulfill the first four of these requirements completely and have the added advantage of regulation in the amount of light, this being a claim peculiar to this system, and presenting an important advantage.

Fig. 3 represents the single-carbon lamp of the Mather-Perkins system. It plainly shows the shape of the globe, and carbon filament and the manner in which the filament is secured in position. The globe is of a fine quality of glass, free from impurities and of uniform thickness to prevent distortion of the rays of the light. The value of an incandescent lamp, of course, depends chiefly upon the carbon. Upon it depends the actual light and the life of the lamp. A poor carbon, if giving plenty of light, may discolor the inside of the globe, and thus shade and waste the light, or it may be so fragile that it soon burns out and perishes. An incandescent lamp cannot be repaired. For this reason it is essential that the carbon be durable and capable of burning many months. The material and construction of the carbons used in the Mather-Perkins system is a trade secret, and it is sufficient to say that the carbon exhibits extraordinary tenacity of life. Long and exhaustive tests have proved that the carbons will give a light of uniform power, without appreciable discoloration of the globe, for many months. In points of electrical value these carbons stand very high. It has been found possible to produce filaments for these lamps, each four inches long, having a resistance of one thousand ohms, and requiring two hundred and fifty volts to bring them to a white glow. This feature is important as it makes it possible to use the lamps with economy at long distances from the dynamo. The resistance of their standard lamp, the Mather Company states, is two hundred and sixty ohms when hot; this makes it the highest resistance lamp, we believe, in commerce at the present time. The material of the carbons also has a mechanical advantage, giving a filament that is hard and elastic, enabling it to stand shaking, sudden blows (as on cars or boats), and other hard usage without breaking. To prevent any possibility of discoloration from the heating of the connections and supports of the carbon, all these parts are made of pure platinum, fused into the glass, no paste, cement or plating of the supports and connections being allowed. (The filaments are fastened to the platinum supports by mechanical pressure.) In regard to discoloration from the burning of the carbons, experiments with lamps containing four carbons have been made, by burning out one carbon after the other till all were destroyed, when the closest examination of the glass, we are told, failed to discover the faintest trace of smoke or dust within the globe. Fig. 4 shows the single-filament lamp of the Mather-Perkins system, inclosed in an ornamental globe that may be suspended or set upright in any electric-lamp fixture.

FIG. 2.—MATHER FIELD MAGNET.

FIG. 3.—MATHER-PERKINS SINGLE-CARBON LAMP.

Fig. 5 illustrates another form of the Mather-Perkins incandescent lamp, and showing a special feature of this system—the use of two or more carbons in one globe. Each carbon is of 16 candle-power, and thus gives a lamp of 32 candle-power, costing only a little more than a lamp of that power. Both carbons are used at once, but, if for any reason one carbon fails, the other still remains as good as ever, and the lamp is available in another place where less light is required. It can be taken out and removed to another room, where a 16 candle-power light may be useful, and thus the usefulness of the lamp be prolonged. Another point is that if one carbon fails, and the lamp is the only one in the room, the place is not left in utter darkness by the failure of one carbon. In Fig. 6 still another improvement in lamp is shown. In this style of lamp three carbons are employed, each of 16 candle-power, and giving, when all are used, a lamp equal to forty-eight candles.

Fig. 7 shows the grouping of four filaments in one globe, and making a lamp of 64 candle-power. In both of these styles—the three and four-carbons lamps—there is the double advantage of greater power and a long life, because if one or more filaments burn out there are still others left to burn. There are practically three and four lamps in one globe, and thus the first cost and the danger of breakage are materially reduced.

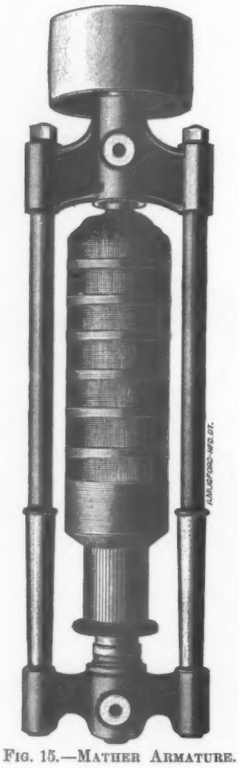

FIG. 15.—MATHER ARMATURE.

In Fig. 8 one of the four-carbon lamps is shown, fitted with a shade for a hall or court light. These four-carbon lamps have also the added advantage of equal illumination all around, one side of the lamp being just as bright as the other.

Fig. 9 shows the 4 carbon lamp, with its base or support. At the right is the handle or key for turning on the light. This lamp presents the valuable feature of "turning down"—that is, it can be arranged to give the full light of all the carbons, or of three, or two, or only one, at will. On turning the key, one carbon is brought to a glow to give light. On turning the key again, another light is added. On turning again, another, and so on till all are lighted. By turning the keys still further, each carbon is extinguished in turn till all are out. This control over the light continues as long as any two of the carbons remain. If one carbon fails, there are still three left, and, if while only one is burning, it goes out, the key can be turned to bring the uninjured carbons into circuit, and the light is instantly restored, and so remains good till all the carbons are burned out.

In figure 10 is shown the mechanism for controlling the lamp. Each carbon is connected with one of the pendant pieces shown in the case enclosing the key. The key carries four circular arms and as it is turned over, each in turn is brought up to the pendant pieces and connects one of the carbons with the current from the main wire.

It is claimed that the lamps used in the Mather-Perkins system exhibit five valuable features of electrical, mechanical and commercial importance. 1. There is no discoloration of the globes. 2. High resistance in the carbons, which makes it possible to use small and consequently cheaper conductors. 3. Superior workmanship and material give the carbons uniform resistance or standard candle-power. 4. All carbons being of standard 16 candle-power, it makes it possible to use lamps of 16, 32, 64 and 96 candle-power on the same circuit. 5. This system of standard uniform candle-power carbons makes it possible to group several carbons in one lamp at a great gain in first cost and cost of maintenance and giving very convenient lamps with a long life, with varying degree of light at will.

In addition to the important mechanical and electrical improvements shown by the dynamos and lamps of the Mather-Perkins system, there are several mechanical appliances in the control of the current that merits attention. These include an improved safety catch and switch.

Figure 11 shows the safety double catch or fusible strip used to prevent an excess of current from entering the branch circuit and destroying the lamps. The safety catch is placed at the junction of a branch circuit with the main line circuit from the dynamo and may be fitted to the wall or placed in any convenient position in the building. The lower figure shows the base of the catch. The upper figure shows the cover that fits over this piece. Spring plugs fit into the holes and press firmly against the bushing in the holes and make a close connection with the circuit. The strip of fusible metal joins the two plugs and forms a bridge for the current. If there is any increase over the usual strength of the current the bridge is heated and melts, thus instantly breaking a connection. The case securely holds the ends of the melted bridge and prevents all danger from fire.

In figure 12 is shown a number of safety catches arranged in a series and placed in a convenient box.

In switches it is important that the lever be so arranged that it can be moved instantly when required. To accomplish this, the switch used in this system is held in position by means of a powerful spring, and when it is desired to shut off any part of the circuit or to extinguish all the lamps in a circuit, all that is required is to release the spring lever by pressure on a small knob. Pressing on the knob moves the lever quicker than it could be done by hand.

The cuts No. 13 show the construction of this switch and the cover and the pressure knob. The switch is designed to be placed on the wall in any convenient position. The next two cuts, Figure 14, show another form of wall switch with its cover, and is designed to be operated by means of a thumb-piece.

The Mather-Perkins system has proved itself to be efficient, convenient to install and maintain, simple in design, and economical in power.

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* * A twelve year-old Dakota girl, taken up into the air by a cyclone, carried out of sight, and brought easily down in a field a quarter of a mile away, describes her sensation while in transit as that of being rapidly and constantly pricked by thousands of needles. Since her experience she has been affected similarly to a person with St. Vitus's dance.

On the Generation of a Voltaic Current by a Sulphur Cell with a Solid Electrolyte.

By Shelford Bidwell, M.A., LL.B.

While observing the secondary or polarization currents which are generated by sulphur cells (as by those made with selenium) after being disconnected from a battery, certain effects were noticed which seemed to indicate that when the electrodes consisted of two different metals, a sulphur cell might be capable of originating an independent or primary current. Experiments were therefore made with the object of investigating this point, and some of the results obtained are here given, though without any attempt to explain them, or to connect them together by a complete theory. They appear, however, to possess sufficient interest to render them worthy of record, from the fact that no voltaic arrangement with a solid electrolyte has hitherto been constructed which, at least at ordinary temperatures, was capable of producing the smallest effect upon the most delicate galvanometer.

A plate of copper about one inch square was heated, and upon it was spread a mixture consisting of five parts of sulphur and one part of sulphide of copper. A plate of silver previously heated was then laid upon the melted mixture, and the two plates squeezed together, thus forming a sandwich-like cell. When this cell, after cooling, was connected with a reflecting galvanometer, the spot of light was violently deflected off the scale. From very careful measurements it appeared that the electromotive force of the cell was .0712 volt, and its internal resistance 6537 ohms. The direction of the current was from the silver through the electrolyte to the copper, and there could be no doubt that it was of a voltaic nature. After the cell had been in existence for about three months its electromotive force had not materially fallen off.

The current was small, owing to the great internal resistance of the cell, and attempts were made to reduce this resistance by diminishing the proportion of free sulphur. But it was found that when the resistance was reduced in this manner the E. M. F. was also diminished, and when there was nothing but pure copper sulphide between the plates, there was no E. M. F. whatever.

Another cell was made, in which powdered silver sulphide without any free sulphur was compressed between plates of silver and copper. This arrangement generated a current, the direction of which was opposite to that produced by the cells above described; but the E. M. F. rapidly fell off, and in three or four days had almost completely disappeared.

When a similar cell was made, in which the silver sulphide was mixed with sublimed sulphur, and placed in the form of a powder between the plates, the direction of the current was, as with simple silver sulphide, from copper to silver. But if the mixture was first fused, and the plates between which it was compressed heated, the current generated by the cell when cold was in the reverse direction. Sulphide of copper was undoubtedly formed in the process of construction.

Consideration of these results led the author to believe that the sole function of the free sulphur in the copper sulphide cell was to form a film of silver sulphide by direct combination with the silver plate. A cell was therefore made as follows:—A layer of copper sulphide was spread upon a plate of copper; a polished steel plate was laid upon the sulphide, and the whole was strongly compressed in a vise. The steel plate was then removed, and a thin layer of silver sulphide was spread upon the smooth surface of the copper sulphide. The cell was completed by pressing a silver plate upon the silver sulphide. This was found upon trial to give a current which, with an external circuit of low resistance, was many times stronger than that generated by any of the cells previously made. Its action was probably analogous to that of a Daniells cell, consisting of plates of zinc and copper in solutions of zinc sulphate and copper sulphate. The quantity of the copper sulphide would be gradually diminished, copper being deposited on the copper plate; while the quantity of the silver sulphide would continually increase with consumption of the silver.

A very curious effect observed in the course of the experiments was the following:—If a battery current was passed for a short time through a cell consisting of two silver electrodes imbedded in a mixture of sulphur and copper sulphide, the cell, after being disconnected from the battery, generated a current of very short duration (not impossibly due to thermo-electric action) in the direction opposite to that of the battery current; and this current, which rarely lasted for more than two or three minutes, was followed by another which was in the *same* direction as the battery current, and was generally maintained for several hours.

*** Fifty points are connected by wire with the Erie, Pa., telephone exchange. Mr. J. H. Francis is the manager of this district, and has built up quite a telephone business.

Fig. 4.—Single-Filament Lamp with Ornamental Globe.

Fig. 5.—Mather-Perkins Lamp with Two Carbons.

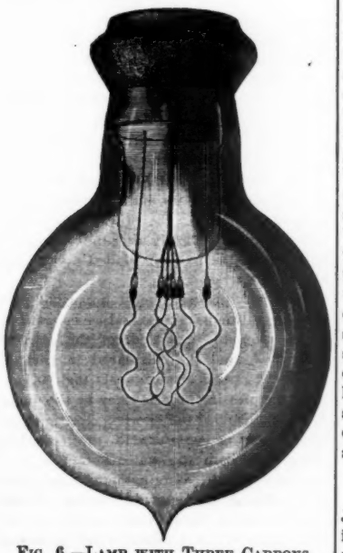

Fig. 6.—Lamp with Three Carbons.

Electric Lighting.

Mr. Preece, electrician to the Post-Office, delivered an address to the British Association which, if not specially interesting or instructive, may serve to remind us all of a curious episode in the history of discovery: It is now twenty five years or more since Mr. Swan—then, we believe, a chemist—patented an electric lamp possessing many of the merits now claimed for the electric light, and very much better adapted for general use than the majority of the lamps which have created such excitement. All Americans are believed in England to be inventors from their cradles. Edison was held in the United States to be the Grand Inventor, and he actually had invented the most surprising, though the least useful, of all modern instruments, the phonograph. He had made an instrument which could report a speech and imitate the speaker's voice. The English people, therefore, believed in him at once, sold its gas shares in a panic at a loss of 20 per cent. on their value, and expected breathlessly the immediate lighting of all cities,—it might be, said the sanguine, through artificial suns suspended 400 feet about each town; and of all houses, it might be, said the same persons, through invisible lights at inappreciable expense. Since that period the progress of improvement in the light has been fairly steady. The electricians have got rid of a shake or quiver in the light owing to intermittent supply, which made it at first painful to the nerves; they have changed the intolerable whiteness of its radiance into a soft yellowness—have, in fact, changed moonlight into sunlight; and they have overcome most of the original mechanical difficulties, such as transmitting the light to a distance, increasing and decreasing it at will, and selling it by measure, which can be exactly ascertained, instead of by time, which cannot be ascertained with the same precision. They have, in fact, made the light quite ready for use, and to a considerable extent it is used. Slowly, but surely, it defeats gas in all buildings where a great body of light is required, or where it is advantageous that the light should be of a certain perfectness, especially for the accurate revelation of shades of color. The popularity of the light has not diminished; the wish for it has increased, while the belief in it has so developed, that if a public demand were certain, millions would be instantly invested in its diffusion. One would hesitate to place a limit on the sums which, if there were even a fair chance of a moderate return from electric lighting, would be instantly forthcoming, to light up the cities of the world. The light, apart from its merits, has a hold on the popular imagination; it is the light behind which there is no other, which can never be superseded; and there is a notion, not in the least justified by experiment, but quite ineradicable, that some day or other it will be cheaply produced,—a notion probably due to the fact that nobody pays for the batteries which produce lightning.

The world is very slow about light, though it wants light above everything. There is no reason why a Japanese or a Hindoo should not have invented a decent lamp 3,000 years ago. There is no new principle in modern lamps, and indeed no principle at all except the law of capillary attraction, which the Assyrian knew just as well as we do. It took the world hundreds of years to get rid of snuffers; and at this moment, with millions dependent on the trade, no one will rid us of the grand drawback to the use of the mineral oils,—their sickening and abominable stench. Purify the oil as you will—and some of the prepared oils look as pure and limpid as water—and still whenever the housemaid is careless—and every housemaid is always careless about lamps—the oil gives forth its poisonous odor. Is it really beyond the reach of mechanical science to make a lamp which, by burning its own smoke or other device, literally cannot smell? We do not believe it; but, nevertheless, though a smokeless lamp would yield a fortune to the inventor, and though every house wants lamps, and though all men have a keen dislike of the smell of burning oil, the necessary improvement will not be made. We still burn oil in machines identical in principle with the Assyrian lamp, though we have learnt to be intolerant of the incense and perfumes with which Sardanapalus kept down, or, so to speak, drowned the abominable stench.

—— Extending down Montgomery street, Jersey City, N. J., about one hundred feet, is a two-story building used by the Pennsylvania Railroad Company for their "electric plant." In this building is generated the electricity which furnishes the currents for all the electric lights used by the company in Jersey City. It also charges the batteries which light the parlor cars. In the engine-room there are four sloping-back boilers, each of seventy-five horse-power. Two of these are used during the summer, and furnish steam for three engines and two pumps. Adjoining is the machine or dynamo room. In it are two No. 7 Brush arc-light machines, with a capacity of sixteen arc lights each, but at present running eighteen each; also two "Weston dynamo-electric machines," with a capacity of 300 incandescent lights each, with 16 candle-power to each light. The Pennsylvania road is experimenting with these lights in nine of their parlor cars, eight of which run to Philadelphia and one to Baltimore. They intend using the light on all their cars as soon as practicable.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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In our next edition will be found a complete report of the most valuable papers read before the Subway Commission during the closing week.

From a statement prepared by Commissioner Montgomery showing the operations of the Patent Office during the fiscal year ended June 30, 1885, it appears that the number of applications for patents received was 32,662; for designs, 1,071; for reissues of patents, 156; for trade marks, 1,126, and for labels, 673, making a total of 35,688, against 38,822 during the preceding year. The number of patents granted, including reissues, was 22,928, of trade marks registered, 1,092, and labels, 337, making a total issue of 24,357. Patents numbering 2,838 were withheld for payment of final fees, and 13,332 patents expired during the year. The receipts of the office from all sources were $1,074,974, as against $1,145,433 during the following year, while the expenditures were $934,123.

The very excellent electric-lighting system of the Mather Electric Company, of Hartford, Conn., is fully described in this issue of the REVIEW. We take pleasure in calling the attention of our readers to the valuable features of this system.

The New York Electrical Subway Commissioners have patiently listened to all the representatives of the various underground systems and electrical companies, and have adjourned to visit Philadelphia, Chicago, and other points, to investigate the systems now in use in those cities. It is expected that a decision adopting some one of the systems presented, will be given at an early day.

Messrs. Wiley and McElroy, of the Standard Cable Company, appeared before the Subway Commissioners on Tuesday, and exhibited the cable of this company, and described its merits and advantages. They stated that the cable was giving satisfaction wherever put down, particularly in Pittsburgh, where it had been laid quite extensively.

The Brush Electric Light Company, of Buffalo, paid a 3 per cent. dividend October 10th, from the earnings of July, August and September. This company is one of the successful electric-light organizations, and is doing a splendid business. Electric lighting, if made to pay, must be managed on business principles, and the capable gentlemen at the head of the company in Buffalo appreciate this fact.

SCIENCE TRIUMPHS OVER NATURE.

Hell Gate has again been the scene of a great event in the history of submarine blasting, and, as Flood Rock, becomes but a memory. A safe, deep channel has been opened for great ships through the Sound to the sea. The spectacle was one never to be forgotten by the thousands of spectators who witnessed it. Nine acres of rock were blown into a million fragments by the terrific force of explosion of one hundred and forty tons of rackarock and dynamite, and the superincumbent waters thrown two hundred feet into the air to fall again seething and angry, now to flow on forever by the dictates of science where Nature had placed her mighty barrier.

This result has been obtained after the labor of nine long years, and an expenditure of a million dollars, the work being commenced in 1876, shortly after the successful removal of the reef off Hallett's Point by blasting.

Electricity played a most important part in this great undertaking, and we cannot but dwell upon the evidences of the extraordinary care and skill displayed in perfecting the electrical arrangements that, at last, upon the pressing of a tiny key by the finger of a child, carried the viewless electric spark with unerring certainty to the countless charges beneath the waters. Of the vast concourse of spectators gathered there, how few realized the supreme agony of the moment before the act was consummated, to those upon whose shoulders rested its success or failure, and yet their hopes and fears were governed by their power to so guide that mystic, invisible fluid into the bowels of the earth that it should do their bidding! To those alone whose occupation leads them into fellowship with this coquettish element would this thought appeal with all its force. Many scientific tests were made in connection with the shock, occasioned by the firing of so large a mass of explosives at one point, and observers from the Engineer Corps of the army were stationed at Bay Side, Patchogue, Pearsalls, and West Point, to note the time of the arrival at these places of the terrestrial vibrations and their general effects—telegraphic signals conveying to them the time of explosion at Hell Gate. At Patchogue, a distance of 48 miles from Hallett's Point, these were felt in 21½ seconds, and at Pearsalls the time was 18 seconds. Observations were also made to detect any possible variation in the earth's magnetic force, but the needle remained unaffected. Furthermore, we would say that whilst the credit of carrying to successful completion the mining operations, is great indeed, the perfect accomplishment of the final act of exploding the mine crowns the whole undertaking as one of the most noted of the day.

Col. M. W. Goodyear, of E. S. Greeley & Co. (formerly L. G. Tillotson & Co.), prepared the battery used on this occasion. Sixty cells were used, each cell having an electromotive force of two volts, with the remarkably low resistance of .04 of an ohm. These sixty cells successfully aroused the 280,000 pounds of explosive material buried at Flood Rock. At Hallett's Point, nine years ago, 960 cells were used to explode 50,000 pounds, sixteen times as much battery being thought necessary at that time to insure the successful explosion of about one-fifth as much material. This marks an advance in electrical science, secured by Lieut. Derby and Col. Goodyear.

THE SUIT DISCONTINUED.

Attorney-General Garland has submitted to President Cleveland the history of the ordering of the telephone patent suit against Alexander Graham Bell, stating in substance that, during his absence, Solicitor General Goode, Acting Attorney-General, had granted the authority to bring the suit in the name of the United States. The president thereupon writes to Mr. Goode, calling that gentleman's attention to the fact that the suit had been ordered without first referring the matter to the Interior Department, which would have been the usual procedure. The President, also, gently hints that some one has blundered, in the following language:

This omission may have been the result of a lack of familiarity with the routine in such cases, or of a perfectly clear and satisfactory persuasion of what should be done, derived from the documents presented to you. Whatever the cause may be, and while such reference is not vital, of course, to the validity of your action, and though I am by no means prepared to question the correctness of the exercise of your discretion in the matter, still the precedent calling for a reference to the department with which the matter is connected is so well established, and seems to me so well founded upon considerations of safety as well as propriety, that I desire to suggest for your reflection the proposition whether such action on your part as will preserve and protect such precedent and custom could not well be taken.

The Solicitor-General promptly displays his ability to take a hint, and replies as follows:

It is true that it has been a practice of this department to refer similar applications to the Interior Department for information and suggestions before final action has been taken. It is also true that, as Acting Attorney-General, I granted the application in this instance without making the usual reference to the Interior Department. This omission was not the result of a lack of familiarity with the routine, in such cases, but of a satisfactory persuasion, derived entirely from the papers presented to me, as to what was right and proper to be done in the premises.

In addition to the affidavits which accompany the letter of the District-Attorney, who made application for permission to use the name of the United States in bring the suit, he transmitted an attested copy of all the writings filed in the Patent Office and the proceedings had thereupon, which resulted in the issue and delivery of the letters patent to Mr. Bell. After a careful examination of these exhibits, which appeared to be duly authenticated, I came to the conclusion that all the necessary information had already been furnished by the Patent Office, and inasmuch as the question presented by the papers for my consideration was a legal one exclusively, I did not deem it advisable to refer the application to the Interior Department for suggestions.

But, concurring with you as to the propriety of the practice which has been generally adopted in such matters by this department heretofore, and being unwilling to take any action which may be regarded as a departure from a wise and safe precedent, I consider it best, perhaps, under all the circumstances, to revoke the permission which has been granted to bring the suit referred to. Accordingly, I have written by to-day's mail to H. W. McCorry, Esq., United States Attorney of the Western District of Tennessee, directing him to discontinue the suit which he was instructed to institute in the name of the United States for the purpose of vacating and annulling the letters patent issued to Alexander Graham Bell on March 7, 1876, and numbered 174,455.

DOMESTIC ELECTRIC LIGHTING.

Whilst the growth of central station lighting by incandescence has been sure and certain, it has also been comparatively slow when compared with arc lighting, which has been due to the fact that it requires for its development certain favorable conditions not everywhere to be found, and, furthermore, that it competes with gas in its most profitable field—that of private lighting. This is unfortunate, for there are now a very great number of isolated cases of private individuals in our flourishing towns and villages whose desire for illumination by electricity is only limited by the ability to get it under almost any reasonable conditions; in other words, it is an admitted luxury, and they are willing to pay for it. We hear of very many isolated private installations in England, and their number is growing every day, yet there seems to be very little done in this direction by our engineers in this country. There would appear to be no good reason for this, as there is also doubt of the latent desire for the light if it could be furnished at any reasonable figure, and with proper insurance of reliability of operation. That this can be done has been amply proven, and we refer to some of the older private installations in England; for instance, that of Mr. W. H. Preece, which he so interestingly described at the Electrical Conference at Philadelphia. It is a wide field, and stretches out away beyond the limits of gas supply. Where gas is at hand, its superior merits have only to be exhibited, and there the argument ends and the question of cost begins. Its desirability is not disputed. It is simply a question of expense; and on this point, as regards maintenance, it seems that electricity is capable of holding its own.

Gas, when used to operate a gas engine, dynamo and system of incandescent lamps, will afford about twice the illumination that it gives when burned in the ordinary way—for light direct. To be sure, this gain is offset in a measure by the attendance that must be given to the plant, but we have arrived at that point now where it should be possible to furnish a plant of this character which would require but little skilled attendance after it is once properly installed. The first cost of a plant of this kind is more than most can afford, yet there is, as before stated, a large minority with whom this point would have but little weight when considered in connection with the advantages gained. On the score of health alone, the expense is justified, to say nothing of the diminished risk from fire. Besides, with electricity once installed in the house, there are numerous uses to which it can be put to enhance the enjoyment of life. Mr. Preece says: "The charm of the whole thing is such, and its cost so trifling, that I shall keep it in my house, and I am quite satisfied that all those who have worked in the same direction in regard to matter of electric lighting will never give it up." Eight hundred dollars ought to cover the entire outlay, and the wear and tear is small; the dynamo will last for years, except for the renewal of brushes; and it is a long time before a gas engine becomes "shaky" with the present improved machine. The breakage of lamps should be but a trifling item, especially if the precaution is taken to give the full current by degrees.

So much for installations where gas can be obtained, but there are our summer residences, the homes of our village magnates, etc. It is safe to predict that the day is not far off when the little glow lamp will flourish here, where oil has so long held sway in all security.

The use of a steam engine without an engineer, owing to the high pressure employed, would be out of the question, but some form of vacuum engine, such as the Davey, could be employed, and with our present improved form of secondary battery, and advanced knowledge as to its manipulation and arrangement, the full charge, or a portion of it, could be given during the day, and the store drawn upon at night for lighting with good results. Still, it must not be forgotten that accumulators require much care and intelligent supervision, but probably not beyond the capacity of the average American

gardener, after a short experience with them under instruction. The probable expense of maintenance would, under this system, be twice as much as it would be using gas burners if they were at hand, and the cost of such an installation as we have in mind, lighting, say, thirty-five to forty lamps, would not be over $800.

Where there are natural advantages to be had, of course the cost of maintenance would be thereby reduced. There are numerous small streams near to almost every town which give a sufficient power constantly, the year around, if we but had a proved and economical system to transmit it. Fortunately, we are far from hopeless in this matter, as it seems very probable that the efforts of Messrs. Gaulard, Gibbs, Zipernowski and Deri have evolved, at length, a satisfactory, practical solution of the problem. The use of windmills as a source of power is too unreliable a method to admit of consideration in this connection, although it has been broached. The plan of domestic lighting by means of accumulators furnished in a charged state, and replaced when emptied, was tried in Paris a few years ago, but abandoned owing to various causes, one of which was the handling of the enormous weight that it entailed. When it is considered that 50 volt lamps, for instance, require at least 25 cells, and that each cell weighs about 100 pounds, we are struck with surprise, not that the scheme failed, but that it was ever started.

Accumulators placed in the house and charged in a convenient dynamo circuit, as operated by Mr. E. P. Roberts, of the Brush-Swan Electric Light Company, in Cheyenne, Wy., have, according to this gentleman, given excellent results in isolated electric lighting. In relation to this matter, he says: "After considerable experience with storage batteries, my conclusion is that they have been both praised and belittled too much. That the service can be good is certain, but that for a closely-settled district they are preferable to dynamos is not, according to my experience, correct." An opinion of this kind is valuable, coming, as it does, from an extended experience with a large installation of accumulators in every-day operation, which is quite a different matter from laboratory work with so coquettish an element. Their bad traits will here appear in all their enormity, as well as their advantages. Lighting by this system should cost but a trifle more than by gas under the same conditions; but, even so, it is idle to compare the two as to cost, except within certain wide limits. It is not simply a question of cost, but also one of health, of comfort, of safety. These all enter into the subject, and must be considered with it.

There have been many attempts to make use of the primary battery for isolated lighting, and, in fact, the first installation of the electric light in Paris depended upon it for its supply of electricity upon the primary battery. The birth of the dynamo-electric machine spoke the doom of the battery's monopoly in this field, at the same time that it gave promise of the new era. However, the galvanic battery was not lost sight of, as technical literature amply testifies, and its advance since those days has been gratifying. There appears to be a field for them in isolated lighting under certain circumstances. Even with our nitric-acid-zinc cell, the computed cost of maintenance does not vary greatly from three times that of dynamos with accumulators, and the original cost is not anywhere near the figure of the latter. So much for this form of battery, but we are promised greater things shortly in this country by means of the new oxide of copper battery. In this the resulting prime product is oxide of zinc, which is a staple largely article used in the arts. This, it is stated, will cover the cost of the metallic zinc consumed, and the expense of maintaining an installation is simply that of periodical attendance for charging and disposing of cell products. Whether this be so in actual practice or not, we shall probably have an opportunity of deciding before long. It has been stated, in a general way, that the expense of lighting an installation of forty ten-candle power lamps will not be far from $1 for six months per lamp—a performance which, however, it does not seem reasonable to expect when it comes to the test.

In conclusion, we will say that this subject, in general, is well worthy the investigation of our electrical brethren.

The time is meet. Business is reviving, and here appears to be a melon to be cut, with no undue force required for the cutting.

Technical education has been defined by Mr. Henry Cunyngham to mean instruction in the art of applying the discoveries of science to the requirements of modern industry. It is not scientific teaching in the strict sense; nor, on the other hand, is it mere craftsmanship. To take an example, the mode of treatment of electrical subjects given in the works of the late Prof. Clarke Maxwell is purely scientific and mathematical; in his hands electricity is an applied mathematical science. In the hands of Faraday electricity becomes an experimental science. But neither the teaching of Faraday nor of Maxwell is of exactly the kind that is suitable for a mechanic. Something more practical is needed; the body of truth must be arranged with a view rather to action than to knowledge. This requires a bent of mind that is midway between science and craft—it is the liberal part of the education of an artizan. We require manual dexterity guided by wide views and scientific knowledge.

GENERAL WESTERN NEWS.

A furious war has broken out among the ticker men of Chicago. The fight is a triangular one, in which the participants are the Gold and Stock Company, the Chicago Commercial and Financial News Company and the Commercial Quotation Company.

The Gold and Stock has formerly charged $6 per week for ticker service, but, as foreshadowed in these columns the other day, the second organization, under the management of Messrs. Van Pelt and Bruce, has fairly established itself as a competitor, with advertised rates of $5 per week; and the patrons, many of whom are Board of Trade men, claim that the service, in addition to the reduction, is thoroughly satisfactory. Then up came the last of the trio with a proposition to furnish the same class of news for $10 per month. This company, which forms the third angle of the triangular duel, is assumed to be of Mackay-Bennett Postal origin, and claims to have equal facilities with either of its competitors.

The agent of the Gold and Stock, when the first shot was fired by Van Pelt and Bruce, decided to retaliate, and issued a circular to all its customers, stating that, commencing October 5th, the rate would be $2 per week. Then the third party fired a shot, the purport of which is that the Commercial Quotation Company will furnish tickers for $1.25 per week—about $5 per month.

Whether these shots are to be continued, or whether the duel will terminate like that in "Bombastes Furioso," when the much-loved heroine of the play comes suddenly on the duelling ground where her three lovers lie, to all appearances, dead, remains to be seen. Let us hope its termination may be as joyous. In the play the sorrowing maiden sings:

"Briny tears I'll shed."
1st Corpse—"I for joy shall cry, too."
2d Corpse—"Why, zounds! the king is alive."
3d Corpse—"Yes, and so am I, too."

The town of Lake Electric Light Company, with a capital stock of $100,000, whose territory adjoins the city corporation on the south, has broken ground for a central station at Forty-sixth street and Packer's avenue near the stock-yards. The officers of the company are F. A. Woodbury, President; C. H. Moore, Secretary; J. W. Brennan, Superintendent of Construction. Mr. Brennan has until now held a similar office in the Chicago Telephone Company. The object of the organization is the illumination of packing houses at the stock-yards.

The systems of lights and dynamos to be used by the company are the Thomson-Houston. The plant will, in the first instance, comprise an Ogden engine, with four 30-light dynamos; and no less than eight of the largest establishments at the stock-yards are included among the consumers. So far, 100 arc lights have been contracted for, but the plant is a flexible one, and it is expected in the near future that at least double that number will be contracted for, when the illumination at the yards is apparent to the good people of the neighborhood, and the darkness in which they now grope becomes appreciable to the touch.

The date for the first flash of light is not definitely settled, but it will be somewhere between the 1st and 15th of November, according to the weather. There will be some six or eight miles of wire in the circuits, it being the intention to run each generator separately in order to accommodate the daily supply to the demand—some parties requiring more hours of service per day than others.

Communication between the consumer and the engine room will be by telephone, the company having merely to come into the exchange as a subscriber, so that distance from the central station is of comparatively little consequence, while all of the parties who will be consumers, are already subscribers to the Telephone Exchange. This is rather an anomalous condition of affairs, and permits of the selection of a proper site for the station.

The resignation of Mr. Brennan from the Telephone Company's service for the purpose of engaging in the above enterprise, has naturally made some changes in the Company's officials. The offices of Superintendant of Construction and of Assistant are abolished, and the General Sup't of the Company, Mr. B. E. Sunny, adds to his former responsibilities by assuming the duties of those officers.

Elgin, Ill., is thirsting and hankering for an Electric Belt Railway. The following is the proposed route: Starting from the Watch Factory, north to Lincoln avenue on Liberty street, west to Brook street, south to Anna street, across the river by the upper bridge, and thence south of place of beginning. The total length of the projected line is about five miles, and it is proposed to make the round trip in fifteen minutes. The estimated cost, including equipment, is $4,000 to $5,000 per mile.

The Central Union Co. has issued its programme for the next grand distribution, $1.50 per share, payable on the 24th inst. This is the 7th dividend.

The recently buried wires of the Chicago Telephone Co. running to their north-side office, were recently tested by the Standard Cable Co., who placed the cables—Waring's patent—and the result proved very highly satisfactory. The insulation resistance mounting up to about 17,000 megohms.

Mr. Clark B. Hotchkiss, general agent for Day's Kerite is in the city, straightening up the Bankers & Merchants' cables, which, owing to the immense haste with which it was necessary to put them in at the time of the rush to get into town, were imperfectly placed. It was one of those cases where there is more haste than speed. Still Mr. Hotchkiss states, that except at joints, or where carelessness has done mechanical injury to the insulation, the wires all prove to be intact and in as good order as ever. The joints were not originally vulcanized, and the sulphurretted hydrogen, illuminating and other gases chemically decomposed the wrapping of the joints. Now, when these are properly covered and vulcanized the joints will be as perfect as any portion of the wire, both as to conductivity and insulation.

The contract for the erection of the telegraph line for the Wisconsin Central Railroad, from Schlesingerville to Chicago, has been awarded to E. G. Knight & Co., of Milwaukee, and work is to be commenced at once. The line is to cost about $200 per mile.

A new departure has just been made in hangers for outside lamps. The new apparatus is simple, cheap and effective, so far as theory goes, and a half-dozen of the electric-light people here are getting up samples. Modesty forbids the mention of the inventor's name, until it has been tried practically. The advantages claimed are that while the lamp may be lowered for trimming, it is as firm as possible when raised, and its support is not dependent upon a rope or cord. It does away with the long loops of wire, this latter being rigidly fixed at all times, and finally, the lamp when lowered is at the inside of the sidewalk, out of the way of passers by. There are no sliding or broken contacts. If it works well in practice we shall know more of it soon.

In the matter of the electric-light ordinance at Milwaukee, there is still more fun for the boys. Representatives of two or more Chicago concerns have been up and down, seeing about it, and arranging matters for a long time. Finally on the 14th of Sept. an ordinance was passed by a vote of 26 to 8, which it was presumed settled the matter.

The Mayor, however, will refuse to sign the bill, and will communicate his objections at the meeting of the Council on the 12th. Then it is expected that there will be a grand marshalling of the clans, and an attempt will be made, according to rumor, to carry the ordinance over the veto.

The Mayor's reason for the veto is that he believes the ordinance in its present form is dangerous to public interest. An element in the conflict is the green-eyed monster which assumes that the gas people are inimical to the electric-light interests. Amendments may perhaps settled the rumpus.

The Great Northwestern Telegraph Co., of Canada, is to have a rival. Advices from Ottawa announce that the Canadian Pacific Railway Company has obtained the necessary power from Parliament, to spread a network of telegraph lines throughout the Dominion, with connections across the border to the United States. A large invoice of wire has been ordered, and work will be commenced at once. The present monopoly will have a formidable rival in the new organization.

Telephone stocks are quoted by Col. S. G. Lynch, 144 La Salle, to-day as follows:

Chicago	$375	@	$400
Central Union	50	@	52
Michigan	62	@	65
Iowa Union	18	@	20
Great Southern	28	@	30
R. M. Bell	45	@	50
M. & K.	54	@	56
United	14	@	15
Cumberland	70	@	75
Pennsylvania	45	@	52
N. Y. & N. J.	61	@	63

CHICAGO, Oct. 13, 1885.

A test talk with the new magnetic telephone was made Sunday between Paramus, on the Erie Railroad, and Conshohocken, by the inventor, Frederick H. Brown, John J. Safeley, Electrician Barberie, of the United Lines and Postal Telegraph Company, and others. The distance is 125 miles. Operations continued for an hour and a half. Conversation was carried on in an ordinary tone over a wire of the United Lines, and the parties present state that the test was in every way successful. The battery connections of the telegraph wires were cut off and the inventor's two instruments, transmitters and receivers, were attached. The transmitter is a horseshoe magnet, either pole being covered with fine wire closely coiled. The armature is a disk of steel, against which the voice is thrown and transmitted through the magnet to the wire. The receiver is of similar construction, having only a smaller magnet. The instruments are inclosed in little circular wooden boxes, which can be carried in the pocket. For use in long distances the size of the magnet is increased.

Telephonic News

⁂ In Belgium a large number of the hotels, cafes and shops are subscribers to the telephone system, and no charge is made at these establishments for talking, it being supposed that the user will take a small refreshment, which is sufficient to recoup the infinitesimal amount represented by such operation.

⁂ The Board of Public Improvements, of St. Louis, refused to grant the request of the Bell Telephone Company, of Missouri, to erect poles on certain streets, holding that the application was not in conformity with the rules of the board. These rules provide for one set of poles for all companies, so there will be but one line on any single street.

⁂ Mr. Gilliland claims a telephonic invention by which two railroad engineers, driving at full speed, can communicate with each other when a mile apart. A man capable of such an invention ought to have the skill to get up a contrivance by which a man running at full speed can attract the attention of a street-car driver or conductor when a quarter of a square distant.—*Captain O. G.*

⁂ The River Plate Telephone and Electric Light Company report an increase in the number of subscribers in Buenos Ayres and Monte Video from 1,573, on 31st January, 1884, to 1,845, on the 31st January, 1885, and this increase represents a corresponding enlargement of income from £26 112 to £29,-226. Later accounts, which are carried down to March, 1885, show that the number of subscribers has been raised to 1,885—the exact number of the year.

⁂ The list of subscribers for this quarter, published by the Sunset Telephone-Telegraph Company, of San Francisco, Cal., presents an array of names that must be very gratifying to the capable general manager, Mr. Jno. J. Sabin, as well as to the stockholders of the company. There are one hundred exchanges and toll stations connected with San Francisco, making a busy toll department. At the recent telephone convention the regret was universal that the genial representative from the Pacific coast failed to be present, but he will be forgiven this time if he doesn't miss another.

⁂ The now famous order of the Department of Justice, authorizing suit in the name of the United States to be brought against A. G. Bell, is given in full below :

H. W. McCorry, United States Attorney for the Western District of Tennessee.

Sir—Yours of the 31st ult., enclosing certain papers with reference to letters patent of the United States heretofore issued to Alexander Graham Bell for improvement in telegraphy, has been duly received. Upon a careful examination of the papers submitted I am of opinion that they make a *prima facie* case sufficient to justify a suit in the name of the United States, to vacate, annul and declare void the said letters patent. You are therefore authorized and instructed to institute a chancery suit in the name of the United States in the United States Circuit Court for the Western District of Tennessee for the purpose of vacating and canceling the said letters patent of the United States issued to the said Alexander Graham Bell, on the 7th day of March, 1876, and numbered 174,455, upon the ground that the same were improvidently issued and were obtained by false and fraudulent suggestion and concealment on the part of the said Alexander Graham Bell.

Permission is also given, as you request, to Casey Young, George E. Gantt, Luke E. Wright and J. R. Beckwith to appear as your associate counsel, with the distinct understanding, however, that the conduct of said suit is to be absolutely controlled by yourself under the direction of this department, and that no liability is to be incurred by the government of the United States for the payment of any fees to the gentlemen named in consideration of their services as such associate counsel. Very respectfully,

John Goode,
Acting Attorney-General.

The order has since been countermanded and suit withdrawn.

⁂ It is reported that the Bell Telephone Company will be asked to make its franchise stock in the New England Company bear the relation of common to preferred to the other stock, the preference to be limited to 4 per cent. dividend.

⁂ The Boston Telephone Exchange has the best record for long-lived cords we have yet seen. Out of nearly 1,200 cords in use since May last, but three have been broken,

Fig. 11.—Mather-Perkins Safety Catch.

and these have been repaired and are again in use. We have before described these cords, which are a combination of tinsel and spiral wire, the suggestion of I. H. Farnham, the electrician of the New England Telephone and Telegraph Company. The excellence of telephone service is largely dependent on the reliability of the connecting cords.

⁂ The statement of Mr. Dickerson that no law could be found for the United States assailing Bell's telephone patents, is confirmed in a singular manner. A bill giving the Attorney-General peculiar powers in instituting suits against fraudulent patents was favorably reported by the House Committee on Patents, but on search it has mysteriously disappeared from the files of Congress. The engrossed copy of this bill, together with all documents and papers relating to the measure, has disappeared from the files of the Senate Committee on Patents. Senator Platt, Chairman of the Senate Committee on Patents, has written to Washington that he wants the matter probed to the bottom.

⁂ The Chicago *News*, of Sept. 26, says: "If New York really wants to clear its streets of telegraph poles and electric wires, let her send the Electrical Subway Commission or the 'experts employed by the companies,' to Chicago. Here they can see the first electrical subway (Dorsett system) ever constructed for practical work, and the wires today, after nine years' continuous service, as perfect as ever and still doing daily duty. They can find over 1,000 miles of underground wires—telegraph, telephone, fire-alarm, electric-light, &c. And if they don't come pretty soon they will not be able to find a single line of wire above ground for any purpose within the city limits."

⁂ It is stated that liquid oxygen and nitrogen rank among the most perfect insulators. The resistance of copper decreases much more rapidly than the absolute temperature, and approaches zero at a temperature not very remote from that obtained by evaporating liquid nitrogen in a vacuum.

⁂ Bell Telephone was quite active at 179 to 180½ on Monday. New England sold at 27 to 27¼. Erie touched 26¼. The July statement of the New England is just out, and the figures for the month and the seven months are as follows :

	July.	Since January 1.
Gross receipts	$79,670 67	$542,630 22
Gross expenses	63,029 32	387,394 53
Net earnings	$16,641 35	$155,231 69
Construction	11,029 74	57,382 61
Surplus	$5,611 61	$97,849 08

⁂ At the regular meeting of the directors of the Erie Telegraph and Telephone Company, held last week, it was voted that a quarterly dividend of one-half of one per cent. be declared, payable to stockholders of record Sept. 30, 1885, to be mailed by check Oct. 26, and that the stock books be closed from Sept. 30, 1885, until Oct. 7, 1885. The dividend is on 48,000 shares and amounts to $24,000. The earnings of the company, it is stated, will permit the payment of this dividend, carry on all necessary construction, keep the lines and apparatus of the company in first-class condition and apply $10,000 to $15,000 quarterly to the reduction of its debt. The last dividend paid by the company was for the quarter ending June 30, 1884, and was for this same amount.

⁂ A house at St. Cuthbert's, ten miles from Wolverhampton, England, is connected by telephone with that town, and is also lighted by electricity. At half-past eight o'clock on the night of the 6th of August, when a single lamp only was alight in the dining-room, and three or four other lamps on the same circuit, a thunderstorm occurred, and suddenly a report like a rifle-shot was heard in the house, and the lamp in the dining-room flashed up and immediately went out. On investigation being made, it was discovered that the telephone wire had been attached to a lightning conductor which protected the house (attached in order to "make earth"); and it was conjectured that a lightning flash had struck the protector, entered the telephone circuit (the wire of which was fused in three places), and then flashed across into the electric-light circuit, producing a very curious and beautiful result, a mirror of platinum being formed in the electric lamp. The scientific result was that lightning does not obey the ordinary law of the transmission of currents—it does not divide itself, but (as is this case) selected one current and discharged its full force in it. A practical outcome of the incident was the necessity shown for occasionally testing lightning conductors.

Fig. 12.—Safety Catches in Series.

About the Opposition Telephone Companies.

We publish below a communication from General Manager Bryan, of the Chesapeake and Potomac Telephone Company, correcting some statements sent us by a correspondent in reference to the opposition companies and their work in Maryland and the District of Columbia. It is evident that these companies stand very little chance of making any progress in the territory controlled by Mr. Bryan's company; in fact, they have never thrived where judicious and efficient management on the part of the licensees of the American Bell Telephone Company has prevailed. We are under obligations to Mr. Bryan, and shall be to any other of our readers for accurate information concerning the telephone business in their territory. Mr. Bryan writes :

Editors Electrical Review :

I find, under the head of "Telephonic News," on page 6 of your paper of the 3d instant, an item, which purports to be news, in relation to the Pan-Electric Telephone Company. This article states that the Pan-Electric Company has extensive exchanges throughout the South—in different parts of Texas, Arkansas and Maryland, and in Washington, D. C. That statement, so far as it applies to Maryland and Washington, is untrue, except that the Pan-Electric Company has an exchange of 12 or 14 subscribers in Baltimore. How many of these subscribers are paying for their service, it would be difficult to tell. It has no exchange outside of Baltimore in Maryland, and it has no exchange, as you state it has, in this city. You state that a number of their instruments are in use by the United States Government. This not a fact. They some time ago put up, without compensation, two sets of instruments for the Government, connecting the Butler building and the Capitol, but the Government gave them up.

Another statement is, "They employ what are known as the Baxter and Long patents, and other inventions." The Pan-Electric Company does not claim to use the Baxter instruments at all, nor does it claim to use any of the Long pattern, so far as I have been able to learn.

You state also that it was against the Baxter patents that the injunction was recently obtained with so little effort by the Bell Company in Pittsburgh. This is not true. It was against the National Improved Telephone Company, of Louisiana, using the original Rogers patents in connection with the Randall and McTighe patents.

Yours very truly,

Sam'l M. Bryan,
General Manager.

Washington, D. C., Oct. 6th.

Improvement in Conductors or Cables for Electrical Circuits.

[Patent applied for.]

When a body charged with electricity is placed near to another body, the electrical equilibrium of this second body is disturbed, and will remain disturbed so long as the two bodies remain more or less near to each other. This influence of electrified bodies on neighboring bodies is termed "electrical induction," and the resulting effect upon the neighboring body is termed "induced electricity."

This disturbance of the electrical equilibrium is the result of the well-established fact that electricities of the same name repel each other, and those of the opposite name attract each other, and, consequently, there is produced a temporary decomposition of the natural electricity in the second body, and the electricity of the same name as that of the electrified body is repelled to the far side of the second body, and the electricity of the opposite name is attracted to the near side, and a recomposition of the electricities of the second body takes place when the disturbing cause, that is, the electrified body is removed. If another body be placed near to the second body the electricity developed in this latter body will decompose the electricity of the body placed near to it. When a current is sent through a wire it induces a wave of electricity in a second wire forming a complete circuit and parallel to it, both at making and breaking contact with the battery, but while the electricity continues to

flow with a uniform potential in the first wire, no inductive effect can be formed in the second wire; and if another wire, forming a complete circuit be placed near to and parallel with the second wire, this second wire will produce in it the same electrical effect as was produced by the first wire upon the second wire.

The quantity of the induced current varies as the potential of the inducing current, and the tension of the induced current varies as the several conductors are better insulated, and as the space between them varies and also as the lengths of the parallel conductors vary.

These induced currents cause great difficulties in circuits used for telegraphic and telephonic purposes.

As it is impossible to change the nature of electricity so as to prevent the influence which electricity passing through a wire has upon neighboring parallel wires forming complete circuits, the object of this invention is to utilize that property which an electrified body has to decompose the natural electricity in a neighboring body, in such a manner as to induce accumulation of electricity in an insulated tube, which does not form a complete circuit, surrounding an insulated wire forming a complete circuit. The induced charges invariably consist of equal quantities of positive and negative electricities, provided no electricity enters or leaves the insulated tube, and if the induced charge in the insulated tube is produced by a current of electricity passing through a wire near to and parallel with the tube, the electricity of the opposite kind to that of the inducing wire is on the side of the tube next to the inducing wire, and the electricity of the same kind is on the farther side of the tube, and these electrical forces being equal, and their lines of force being at right angles with the enclosed wire, a current cannot be induced in the wire.

I am aware that an insulated wire enclosed in a metallic shield, the said shield also insulated has been devised, and the metallic shield has been used either to complete a metallic circuit, or has been connected to the earth at both ends or at intermediate points.

My arrangement differs from them in a very essential feature—that is, the metallic shield is insulated throughout its entire length and at its extremities, so as to prevent contact of the metallic shield with the air or with any material; and, as the metallic shield does not form a complete circuit nor part of a complete circuit, there cannot be produced by induction a current in it, and the inductive effect upon it of currents passing through neighboring parallel wires will be the decomposition of the natural electricity of the shield, so that the electricity of the opposite kind to that of the inducing wires will be on the side of the tube next to the inducing wires, and the electricity of the same kind will be on the farther side of the tube, and these electrical forces being equal, and their lines of force being at right angles to the enclosed wire, a current cannot be induced in the wire.

It is not necessary that the metallic shield should be continuous throughout the entire length of the parallelism of the wires, but the shield may be in sections separated from each other by a small space of about one or two feet, each section to be insulated throughout its length and at its extremities.

Having now described my invention, I claim—

1. The combination of an insulated wire with a metallic cover, insulated throughout its entire length and at its extremities.

2. The combination of an insulated wire with a series of metallic covers, placed at short distances apart, and insulated through out their lengths and at their several extremities.

Any number of these conductors can be bound together and covered with hemp webbing, saturated with gas tar. A trench about two feet deep, in the bottom of which is placed sand to the depth of five or six inches; on this sand the cable can be laid, and then covered with a few inches of sand, on top of which is placed a board saturated with gas tar, then filled up and the paving-stones placed.

Editors Electrical Review:

As a sequence to my letters] published in your REVIEW on the 8th and 29th of August last, I send you the full description of my conductor, and I earnestly invite criticism of it from you or from any of your correspondents and others.

The insulation I prefer for the core and metallic cover is cotton saturated with paraffine.

Yours truly,

Grand Central Hotel, New York, Oct. 5, 1885. W. C. BARNEY.

.... At a recent meeting of the electrical committee of councils in Philadelphia, an ordinance granting the Bankers and Merchants' Telegraph Company the privilege of laying underground cables and wires in certain streets was reported favorably, with an amendment changing the route from Market street to Arch street, and limiting the time for the work to one year. The same limit was allowed the Western Union Company.

.... The Anglo-American Cable dividend is announced at five shillings per share, against ten last year.

.... A telegram from London says: "The London managers of the Atlantic cable companies in the present pool will meet in this city during the week. It is positively asserted that the object of the meeting is to arrange for a reduction of the present cable tariffs between England and the United States from twenty-four cents to twelve cents on ordinary or commercial messages, and from twelve cents to six cents on press messages. The directors of the different English companies in the pool are said to be all in favor of making the proposed reductions. They take the ground that the opposition of the Mackay-Bennett cables must be ended by annihilation. This opposition, it is argued, has already made the pool dividends so small that the shareholders will consent to sacrifice them entirely for a time in a war of rates that will either break down the opposition or compel it to join the pool, and result eventually in raising the tariffs all around and in an eventual increase of the pool dividends."

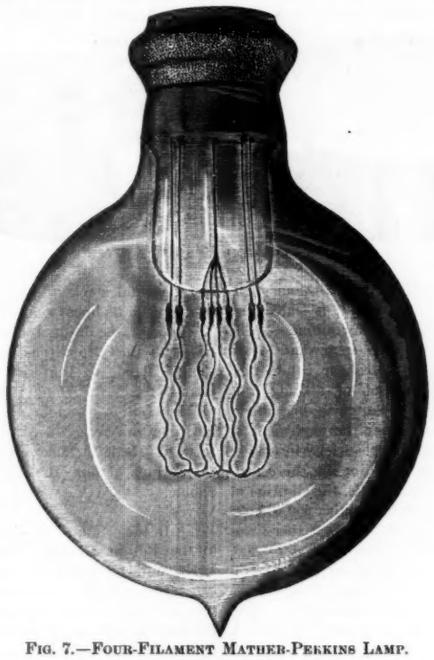

FIG. 7.—FOUR-FILAMENT MATHER-PERKINS LAMP.

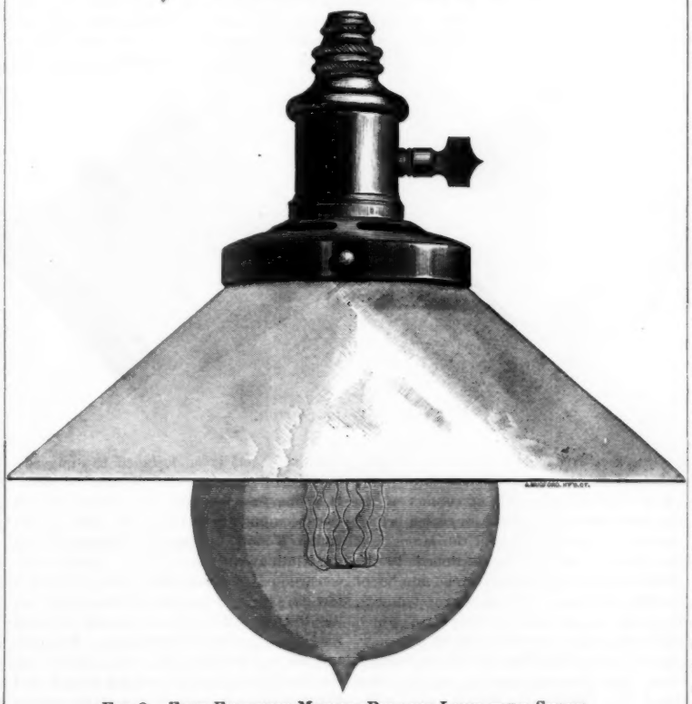

FIG. 8.—FOUR-FILAMENT MATHER-PERKINS LAMP WITH SHADE.

TELEGRAPHIC

.... Little Rock, Ark., is very happy over the fact that she is now to enjoy some competitive telegraphing, the B. & O. office having been opened there.

.... Forty-three patents have been issued to Henry C. Spalding, of Boston, for an apparatus for the construction of electrical conductors for underground telegraph wires and submarine cables.

.... Irving S. Fitch, one of the oldest and best known telegraph operators in New York, dropped dead the other morning on an elevated railroad train. Mr. Fitch had for several years been an assistant metropolitan superintendent of the Western Union Telegraph Company.

.... "It's a wonder," remarks an excited exchange, "that the telegraph companies ever let the special delivery bill pass. If they had stopped to think of it, they would have seen that it was a big encroachment on their preserves. Now it will be but a step to a national telegraph system."

.... The Chicago, Burlington and Northern Railroad Company are pushing the work on their telegraph line, three car loads of poles and fixtures being unloaded at Galena, Ill., last week, and soon after a gang of men commenced putting up the line along the proposed route of the railway.

.... The Baltimore & Ohio Telegraph Company has completed its lines to Little Rock, Ark., and opened for business. The opening is notable from the fact that this is the first opposition company that has ever succeeded in extending its lines to Little Rock, and the Baltimore & Ohio have only done so after a bitter and prolonged fight with the Western Union in which every obstacle has been thrown in the path of the new company.

.... The trouble which has been brewing between the Western Union and the Bankers and Merchants' Telegraph companies came to an open rupture, Saturday night, at the Connotton Valley Railway Station, near Cleveland. It is claimed that the Western Union men cut the wires of the Bankers and Merchants' just below the Connotton Valley Station. J. A. Simmons, manager of the Bankers and Merchants', with a force of men, repaired the damage and disconnected the Western Union wires.

.... Mr. Bofinger, the enterprising president of the American District Telegraph Company, of New Orleans, states, that his office at the present time is one of the most thoroughly appointed in the country; they have been preparing to move for a month, yet did not actually make the move until 8 A.M. Sunday morning, and in less than four hours they were in perfect shape for business, and did not lose a call. This was owing to the fact that all the wires and batteries had been duplicated, and Mr. William Young, the experienced electrician, had taken every precaution to have everything nicely adjusted before attempting to make the change. The gravity batteries number 200, working twelve circuits, with 800 instruments. There are also, in addition, twenty Leclanche batteries for local use. Mr. Bofinger takes great pride in his corps of messengers; they are neatly uniformed and sprightly and intelligent in their appearance. They are taught manners and are respectful and courteous in their bearing. He states that not unfrequently he is called upon to recommend one of his corps as an office boy, and as this is an advancement and opens up a business future for the youth, he recommends one of the best, which creates a spirit of emulation among the rest. These boys are thrown into close contact with all classes of business, thereby acquiring a valuable knowledge that could not be obtained otherwise. O. J. Paul, the capable general manager of the company, deserves credit for their careful training.

ELECTRICAL AND SCIENTIFIC

* * Amongst the lepers at the Misken Hane, at Scutari, is one who is said to owe his malady to a lightning stroke.

* * At the meeting of the British Association, Mr. J. J. Colman gave an account of experiments with a modification of Daniells' battery, in which he used iron as the electro-positive element, and found it the more permanent arrangement, the cell remaining intact for a much longer period. A slight deposit of sulphate of copper forms on the iron, but it is easily rubbed off.

* * Among the recent incorporations is the Chicago Electric Railway Company, capital stock $100,000, for the construction of railways and tramways upon which electricity may be used as a motor power: incorporators, William G. McCormick, David G. Hamilton, and S. E. Stanley. Another company just incorporated there is the Western Thompson-Houston Electric Company, capital stock $500,000; incorporators, Chas. Cooper, William A. Comstock, and Charles C. Doolittle.

* * There is a project at Elgin, Ill., to construct an electric railway, starting from the watch factory, running on Liberty street north to Lincoln avenue, thence west to Brook street, thence south to Anna street, thence crossing the river by the upper bridge, thence south to the watch factory, making a total distance of five miles, to be traversed in fifteen minutes. It is said the road can be built and equipped for $4,000 or $5,000 per mile. This will bring the available building portion of the city into immediate use.

* * It is stated of the new metal, gallium, that, with the exception of mercury, which only becomes solid at 37.9° Fah., there is no other element which liquefies at so low a temperature. It melts at 81.1° Fah., so that it liquefies when held in the hand. The metal is hard and resistant, even to a few degrees below the melting point. It can be cut, and possesses a slight malleability. When fused, it adheres easily to glass, on which it forms a beautiful mirror, whiter than that produced by mercury. It oxidizes but very superficially when heated to redness in the air, and does not become volatile. Unlike lead, it acquires only a very slight tarnish on exposure to moist air. Its specific gravity is a little under 6, that of aluminum being 2.6, that of zinc 7.1, and that of lead 11.4. Unlike lead, again, gallium is a highly crystalline metal, its form being that of a square octahedron. In its chemical characteristics the rare element gallium shows the greatest analogy to the abundant element aluminum.

* * The Boston and Maine Railroad Company has just contracted with the Judkins Electric Signal Company to equip all its passenger cars and locomotives, of both divisions, with the signal, which supersedes the bell rope, and which gives an automatic alarm in case the train parts. The number of engines is 261 and cars about 475. Manager Furber carefully investigated for several weeks before laying the matter before the directors, and conferred with Superintendent Folsom of the Boston and Providence in regard to the working of the signal on his road. The Maine Central will now equip with it, and the Central Vermont, Passumpsic, Southeastern and Grand Trunk are considering it. The work of equipping the through trains between Boston and Montreal over the Boston and Lowell and these other roads is nearly completed. All the passenger trains of the Concord and Portsmouth have taken it. The Milwaukee and Northern has adopted it. The Erie has tried it. Considering that it was introduced only last May, it is meeting with great success.

* * Charles F. Pidgin, Chief Clerk of the Massachusetts State Bureau of Statistics, started to make an instrument on which every step in addition would be performed mechanically without any puzzling side-rules, and he seems to have succeeded. One movement brings any single digit from one to nine into its proper place; the instrument carries automatically, and any digit may be added to a number already down by two motions of the hand. The power of the electrical battery and the size of the machine alone limits its capacity, and its speed is from two to six times that of the most expert accountant. Anyone, it is stated, can learn to operate it in a few minutes. The record is shown on dials somewhat in the same manner as on street-car conductors' registers, except instead of making nine motions to register nine units, one movement only is required, and the movement of the dials is effected by electricity instead of by cogs. On the machine in the census office, which has nine dials, the addition of one unit to the registered number 999,999,999 sets all the dials at zero, so that if there was another dial, record would be 1,000,000,000.

* * In his lecture on the method of producing electricity from heat, Prof. A. L. Arey, of the Buffalo Electrical Society, said: "The discovery was first made by Seebeck in 1822, that one electric current might be generated in a close circuit by warming the point of junction of any two dissimilar metals. By soldering together a piece of bismuth and a piece of antimony, and connecting their free ends with a low-resistance galvanometer, a current will flow through the latter whenever the points of contact of the two metals are heated above, or cooled below, the rest of the circuit, and the strength of the current will be proportioned to the difference of temperature and the number of metallic junctions. The excess of temperature sets up an electromotive force which will maintain a constant current in the circuit as long as the difference of temperature lasts. The current flows in one direction when the junction is heated, and in the opposite direction when it is cooled. Several years later Peltier discovered the converse of these phenomena, having found that a current of electricity in flowing through a junction of dissimilar metals heats or cools the junction according to the direction of the current. The electro-motive force of a single pair dissimilar metals is very feeble, and hence in order to increase the force a number of pairs, preferably of bismuth and antimony, are joined in series, and so bent that every alternate junction can be heated, while the remaining sets remain cool. When so constructed this arrangement is called a 'thermo-electric pile,' and is an invaluable instrument for detecting and measuring excessively small differences of temperature."

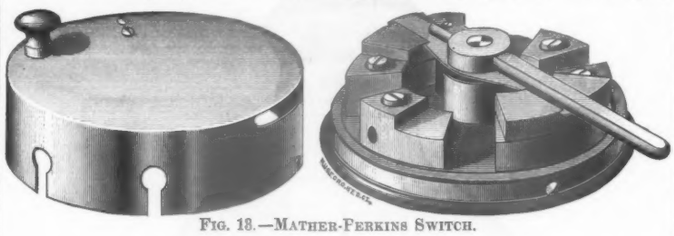

FIG. 13.—MATHER-PERKINS SWITCH.

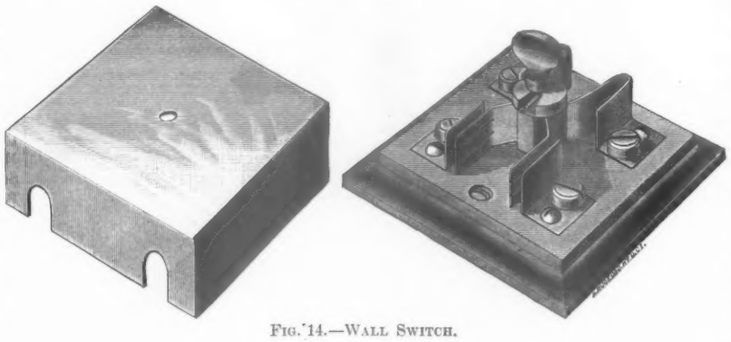

FIG. 14.—WALL SWITCH.

* * One of the most remarkable instances of the reconciliation of science and faith is found in the case of the Rutgers College seismologist, who noted at New Brunswick the shock of the Flood Rock explosion just one minute after the appointed time, and just fifteen minutes before the explosion actually occurred. For promptness in all things commend us to old Rutgers.

* * A certificate of incorporation has been filed in the office of the County Clerk on the part of the Pennock Underground and Surface Railway Company. The company has a capital stock of $100,000, and it intends to run its lines from this city to Brooklyn, across the bridge or under the East River to Fort Hamilton, with a branch to Coney Island, to Port Richmond, Staten Island, to Perth Amboy, and also to the different cities throughout this State. Its incorporators are: George B. Pennock, A. Edward Healey, James Williams, Eugene A. Farrar, Arthur R. Minocks, John B. Sabine, Edward V. Wedin, and Alfred J. Voyer.

* * In the center of the largest apartment in the Edison Machine Works, in Goerck street, stands a mammoth piece of mechanism on four wheels. A large force of skilled workmen have been engaged in building it for some months, and they are now putting on the finishing touches preparatory to the experiments which are to test its powers and its capability for performing the work for which it is intended. When completed it will be an electric motor and passenger car combined, and it is designed to supersede the use of steam on the elevated railroads. It is the first machine of its kind that has ever been built in this city, the Daft motor, which is now undergoing experiments on the Ninth avenue elevated road, having been constructed in Greenville, N. J. Within a few days the new machine will be placed on the tracks of the Second avenue elevated road for experimental purposes. The central rail which will receive and conduct the electricity is in position between Grand and Fourteenth streets and only awaits the arrival of the glass insulators from the factory in Pittsburgh to be ready for its destined mission. The third rail will at once be extended to the generator or central station, which is located on East Twenty-third street. In this central station are five dynamos of forty-five horse-power each, and the electric energy from this point will be transmitted to the center rail for the propulsion of the trains. The motor has been constructed under the immediate direction of Thomas A. Edison, Stephen D. Field, Superintendent Charles Batchelor, and H. E. Walter as electrician and assistant superintendent. It will be a passenger car with self-propelling powers and will be started, stopped, lighted, heated and controlled by electricity.

New Use of the Battery as a Motor.

Dr. McLean purchased a large bay mare to match his bay animal, and proposed to drive her in a double team to his buggy. He hitched them up together and started them up. His old horse started, but the other did not. She appeared to be hitched wrong end to, for she wanted to go stern first. The doctor tried moral suasion strengthened by a whip he had. The mate dragged her but it was no use; he could not get her to go the right way, so he conceived the idea of trying an electric charge. He hitched her with a strong mare to a heavy dray, and, attaching a battery, he arranged two wires, one leading to her head and the other ending under her tail. Then they started, or rather did not start. She began to balk and back. The doctor opened out the charge from his battery, and that mare had a peculiar sensation under her tail. She couldn't kick, for her tail was tied down. She looked back, and there stood the doctor smiling, but not saying a word. She looked at her mate, who was quietly blinking his eyes and switching the flies off, utterly oblivious. The electricity still kept her tail end interested. Taking in the mysterious situation, it was too much for her. She lay down and bawled. She screamed with fright and consternation. The doctor then put on another charge heavier, which helped her up like a flash, and off she went like the wind. When she would go too fast he would give her a charge in front. When she would back he would startle her with a charge around the root of her tail. It completely cured her. She does not believe in electricity, and has, in consequence, quit balking.

* * The most ambitious project yet broached for employing electricity as a universal motor is at present under consideration at Quebec. It has its origin in the successful use already made at Montmorency Falls as the source of power for lighting Dufferin Terrace by electricity. It is now proposed to put the famous waterfall at work not only to run a short electric railway, but to furnish electric power superseding steam in all the factories and workshops of Quebec. The utilization of natural waterfalls for this purpose is already known to be entirely practicable. One of the first electric railways built as a business enterprise was, we believe, that at Portrush, opened by Lord Spencer some years ago. It derived its energy from a neighboring waterfall. Near Grenoble a similar experiment was made, the waterfall being made to work a printing press, a sand mill and other machinery in the city. These, however, were small affairs compared with the scheme now proposed in Quebec. Should that be successful, great waterfalls would acquire a value besides that of their picturesqueness, and the practical man would no longer lose his enjoyment of their beauty in his regret over the amount of power allowed to go to waste. It is clear that the disposition to use electricity as a motive power is again becoming urgent. For a time its work in lighting absorbed attention, and certain objections on the grounds of economy, convenience and safety also seemed to oppose obstacles to immediately employing it for transportation. But now both in New York and Philadelphia this use is again seriously urged. In Philadelphia, we believe, an electric railway is expected to be regularly running within a month, and in New York the experiments with electric motors on the Ninth avenue elevated road continue to be made. Electric railways have been established for years, on a small scale, in Germany, Austria and Belgium, and elsewhere, and electric omnibuses and boats have been used in Paris and Vienna. Toronto, also, put in operation last month an electric railway, about a mile long, to carry passengers to and from the neighboring fair grounds. Quebec, however, will be entitled to take the lead, for the present, in widening the uses of electricity, if she really succeeds in carrying into effect her projected work with the Montmorency Falls.

—— In the Gant electro-motor the central part is a drum constructed of metal or wood, with as little weight as possible. The conducting wires from the pole reverser to the armature magnets are inside the drum. The armature magnets are bar electro-magnets laid parallel with the axis, and connected throughout.

—— A brilliant beam of light fell upon the Delaware River far below the Neck Saturday night for three hours from the direction of West Philadelphia. It was the strong ray of the United States search light in the tall tower at the Novelties Exhibition, which was used that evening for the first time. The immense lamp weights 1,000 pounds, is of 12 000 candle-power and can be seen for a distance of fully twenty miles. Power is supplied by an engine running a Weston dynamo.

—— The electric light is rapidly taking possession of large properties, such as commercial establishments, manufactories, public institutions and shipping. It is now not only installed but in full use in four ironclads. The Colossus has been fitted throughout with this light, and so has the Chilian warship Esmeralda. The Brazilian vessel Richulo is electrically lighted, and the Aquidaban, the iron-clad recently built for the Brazilian Government by Messrs. Samuda Bros., and now lying in Millwall Docks, was completely lighted up by electricity recently. Any one who has explored the depths of an ironclad can readily conceive the value of the electric glow lamps in such subterranean, or rather subaqueous regions. There illumination is not only cheerfully bright and thorough, but is accomplished without polluting the air and aggravating the inevitable closeness of the atmosphere at such a depth from the deck. In the vicinity of the magazine they excite no alarm. No pitch or roll can affect them, and in storms they will shine as steadily as in a calm, mitigating by their cheery glow the miseries of the weather. In the Admiral's rooms and the officers' quarters they are a veritable luxury; while for all work on deck, including the loading or unloading of stores, their capability of being grouped under a shade and used as a pendant light at any height or depth, renders them of the highest utility. All these advantages are obviously obtained to the full in the arrangement of the 220 incandescent lamps with which Messrs. R E. Crompton & Co. have supplied the Aquidaban. But for the purposes of an iron-clad another adaptation of the electric light is of paramount importance, and Messrs. Crompton & Co. have therefore also fitted this vessel with two great search lights—arc lights of 25,000-candle power nominally, but of greatly magnified intensity when their beam is concentrated by the mirror arrangements of the lamp and projected as it may be for long distances on either side of the ship. One of these powerful lights is placed aft, and the other in an elevated position in front of the bridge. By a special invention the mirrors of the huge projectors, as well as the whole of the incandescent lamps, are so hung as to minimize the risks of fracture from the concussion caused by the firing of the heavy guns in the turrets. The dynamos driven by the

FIG. 10.—SHOWING MECHANISM FOR CONTROLLING LAMP.

compound Willans engine work with surprising gentleness and freedom from vibration. Sir E. Reed, member of Parliament, was present at the successful trial of the electric lighting of this ironclad.

—— The goverment having paid $20,000 for an electric-light plant in the Chicago Custom House, is at a loss to discover why the plant should not be utilized. The system had been successfully operated at the Boston Custom House and a saving of sixty per cent effected. The saving at the St. Louis public building by use of electric lamps had been $800 during the last month, and as the government has paid over $50,000 per annum for gas in New York city, the electric system is to be introduced there. With the electric plant all right in the Custom House, it lies idle, while the Chicago Gas Light and Coke Company furnish light which cost the government $1,001.80 last month. There is a good sized African in this government wood pile which the authorities are determined to discover, and the gas company will find itself throttled.—*The Western Manufacturer.*

FIG. 9.—FOUR-FILAMENT LAMP, SHOWING BASE AND KEY.

—— "Yes, we are hard at work, as you may see," said John Barlow, Jr., the builder from the Seventh Ward, Trenton, N. J. And, indeed, the masons, sixty-five feet in the air, were most busily engaged in laying bricks on the big stack of the electric-light building, and many were the calls for "more mortar." "It will not be long before the entire seventy-eight feet will be finished, if the weather be favorable. The stack will be surmounted by a seven-foot iron head, which will weight when placed in position about 1,800 pounds. We cannot rush matters at too great speed on account of the great mass of brickwork. The foundation, you see, is ten feet square, while the depth is six feet six inches. Regarding the building proper, the foundations of three sides have been laid. When will we be done? That is indeed a hard question, but I hope by the end of November. Of course a thousand and one things may hinder us, still we may reasonably expect to see the 'plant' in operation by December first."

—— In the *Organe Industriel Hebdomadaire*, of Brussels, the invention of the incandescent lamp is claimed for Belgium. In 1838, Jobard, of Brussels, proposed as a source of light a small carbon in an exhausted receiver, and rendered luminous by means of an electric current. De Chanzy, in 1844, repeated these experiments, and patented the devisibility of the electric light. About the same time, Starr, of Cincinnati, constructed a lamp with a platinum wire, which King afterwards replaced by a filament of carbon. Staite employed iridium in 1848, and in 1859, Du Moncel indicated the different tissues which, when carbonized, gave the best effects of incandescence. Finally, M. Somzee, on November 5th, 1879, obtained a patent in which it is claimed are given all the essential conditions for the glow lamp as now known, as to the kind of carbon employed, the form and section of conductor, the means for its preservation, and the nature of the receiver or globe.

—— The Cohasset mills, Taunton, Mass.' are putting in an electric-light plant, Thomson Houston system.

—— Havlin and Erlanger, the managers of "Dagmar," carry with them an enormous electrical machine, built especially for the purpose. It is of thirty thousand candle-power, and is used in photographing the audience from the stage every night, a copy being presented to every person attending the performance. The invention is Mr. Erlanger's, who says: "The peculiar construction of a theater, the deep galleries throwing heavy shadows and the amount of gilt used in the decoration are serious obstacles in the way of securing a good negative, but we have overcome them. Every face in the audience is reproduced and can be easily recognized in the picture. We expose four plates each evening and they are developed and the pictures are printed in New York."

ELECTRIC LIGHT NEWS

—— The German branch of the United States Company has applied for a concession to establish at Frankfort a central station for the distribution of the electric-light and the transmission of power.

—— Experiments have recently been made in France with a view to the application of electricity as a curative agent in cases of Asiatic cholera. The results, although interesting, have not yielded unqualified satisfaction.

—— In Denver, Col., they are discussing the question of lighting the streets of the city with electricity. Members of the city council are in favor of electric lighting, if the expense is not too great. When they consider the superiority of this illuminant over gas, the slight difference in cost should not be a stumbling-block. The enterprising citizens of Denver are not the men we take them to be, if they permit this to prevent their having the electric light.

—— On Tuesday night last the Electric Light Company completed its system of lighting West Indianapolis so far that fourteen of the eighteen lights were in effective operation. There remain four to place and complete, which will be done this week. This flourishing suburb will then have a system of electric lighting as good as any in the State. The citizens say the light is equal to that made by four or five gas lamps to a square, and that there is little or no fluctuation in its brilliancy.

—— In a paper recently read before the Paris Academy of Sciences on the increase in the luminosity of incandescent carbons with the intensity of the electric current and the consequent temperature, and the diminution of the luminous intensity after a certain point (about 4,713° C.) is passed, M. Felix Lucas argued that it is probable that the thermic radiations, which are at first dark and then luminous, passing from red to white, ultimately go beyond the violet rays and cease to be visible.

—— For testing the quality of leather used for belting, Mr. Eitner proposes the following simple method:—A small piece is cut out of the belt and placed in vinegar. If the leather has been perfectly tanned, and is therefore of good quality, it will remain immersed in the vinegar, even for several months, without any other change than becoming of a little darker color. If, on the contrary, it is not well impregnated with tannin, the fibres will promptly swell, and, after a short time, become converted into a gelatinous mass.

—— In the city of Santiago there are some 2,000 incandescent lights being maintained from a central station. In Valparaiso there are 110 Brush lights employed in lighting the General Post Office, hotels, dining-rooms, billiard halls and shops. The Brush people have lately exhibited a tower-light consisting of five 4,000 candle-power lights, mounted on a mast 65 feet high, which is located on a hill some 200 feet high in the heart of the city. This light is seen at sea over thirty miles away, and similar lights are soon to employed in lighting the towns of the interior.

—— In the *Journal of the Franklin Institute* for October, the following mention is made of the "Otto" gas engine:—"Schleicher, Schumm & Co., of Philadelphia, exhibit three of their standard "Otto" Silent Gas Engines, respectively of four, seven and fifteen horse-power, the two former driving, the first a 25-light dynamo, and the second a 40-light. These engines have but one cylinder, in which the combustible mixture is compressed and exploded during alternate revolutions. It is claimed that this engine possesses the least number of working parts, and the greatest simplicity of mechanism obtained in a gas engine, or even in many steam engines."

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCT. 6, 1885.

327,393 Auxiliary mouth-piece for telephones; Charles A. Harrison, Bridgeport, Conn.

327,458 Underground conductor; Peter McMackin, Lonsdale, R. I.

327,459 to 327,500, inclusive, cover forty-two patents granted to Henry C. Spalding, of Boston, Mass., for improvement and new inventions of various kinds of electrical apparatus.

327,525 Electric valve operator; Chas. L. Clarke, New York, N. Y.

327,526 Telemeter system; Chas. L. Clarke, New York, N. Y.

327,527 Telemetry; Chas. L. Clarke, New York, N. Y.

327,536 Electro-magnet for signals; Wm. E. Davis, Jersey City, N. J.

327,578 Incandescent electric lamp; Jno. Nelson, Rockford, Ill.

327,582 Battery electrode; John B. Odell, Chicago, Ill.

327,657 Method of operating circuits in telemeter systems; Charles L. Clarke, New York, N. Y.

327,690 Elevated electric railway; Andrew Jackson, San Francisco, Cal., assignor of one-half to John E. Savage, same place.

327,692 Arm rest for telephone uses; Frank G. Johnson, New York, N. Y.

327,790 Dynamo-electric machine; Edgar Granert, New York, N. Y.

327,795 Incandescent electric lamp; Chas. Heisler, St. Louis, Mo.

327,796 Incandescent electric lamp; Chas. Heisler, St. Louis, Mo.

327,797 Electric motor; Moritz Immisch, London, England.

327,837 Telephonic apparatus; Silvanus P. Thompson, Bristol, England.

327,878 Electric battery; Charles W. Holtzer, Boston, Mass.

327,886 Magneto call for telephones; Albert H. Low, Denver, Col.

327,888 Floating current motor; William Main, Brooklyn, N. Y., assignor to the River and Rail Electric Light Co., of Ohio County, W. Va.

327,889 Floating current motor; William Main, Brooklyn, N. Y., assignor to the River and Rail Electric Light Co., of Ohio County, W. Va.

327,897 Secondary electric-clock movement; Chester H. Pond, Brooklyn, N. Y.

327,898 Electrical attachment for winding clocks in series; Chester H. Pond, Brooklyn, N. Y.

327,908 Electrical measuring instrument; Edward Weston, Newark, N.J., assignor to the United States Electric Lighting Company, New York, N.Y.

327,911 Printing telegraph receiver; Aloys Wirsching, Brooklyn, N. Y.

327,919 Watch-stand alarm; Jacob Burrmann, Bienne, Switzerland.

327,941 Thermostat; George L. Gray, Chicago, Ill.

327,964 Cut-out for secondary batteries; George B. Prescott, Jr., Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

BUSINESS NOTICE.

More Important Notice

THAN THAT ISSUED BY THE ANSONIA BRASS AND COPPER COMPANY, AND HOLMES, BOOTH & HAYDENS, SEPTEMBER 17, 1885.

To Electric-Light Companies, Telegraph and Telephone Companies, and other parties making or using Insulated conductors:

The owners of the Letters Patent granted to A. A. Cowles, February 20, 1883, for insulated electric conductors, are seeking to disturb the trade by an assertion that parties purchasing insulated electric conductors manufactured by others than the Ansonia Brass and Copper Co., or Holmes, Booth & Haydens, will be subjected to legal penalties.

We beg to assure the trade that we believe, and as advised by competent counsel, that the said Letters Patent of Cowles are utterly valueless. The substance of the claim of invention is an insulated jacket composed of a layer of fibrous material, then a layer of paint in an undried state, and finally another layer of fibrous material. This method of insulating electric conductors is almost as old in the art as the use of wires requiring to be insulated.

Compound coverings for insulating wires, composed of layers of fibrous material, cloth, ribbons, yarns, etc.; superposed coatings of paint, resin, paraffine, red lead, etc.; and an outside covering of ribbon, cloth, yarn, or other fibrous material, with the fibrous constituents of the jacket applied to the paint or other insulating constituent while the latter are in the green or undried state, is more than twenty years old, and is described in a great number of Letters Patent of prior date to the Cowles patent of Feb. 20, 1883.

It is true that suit was brought against the Electrical Supply Co. upon this patent, and the defendants answer was put in a year ago. The answer sets up evidence that both kills the patent and buries any pretended claim to the invention. The plaintiffs have rested quietly during the past year without moving in the case, but now, as the fall trade is opening, a flamboyant circular is issued, but this display will be, we assure the public, the last demonstration that the complainants will make in the case.

We hereby guarantee purchasers and users of our goods absolute protection against any liability under the Cowles patent.

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September 30, 1885.

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In straightness, length of time in burning, brilliancy and steadiness of light they excel all others, and are adapted to the various systems of lighting in use.

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¼ to 20 Candle-Power.

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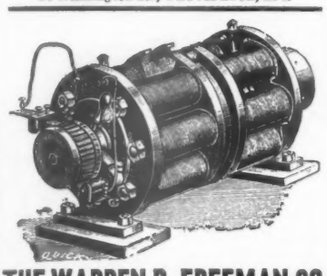

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Attorneys in Patent Causes And Solicitors of Patents.
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(Wood's Patents.)

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"Among the different systems of arc lighting may be mentioned the Brush, the Weston, the Schuyler, the Thomson-Houston, and the Fuller-Wood (hereafter to be known as the American). The Fuller-Wood system of arc lighting has gained a world-wide reputation for reliability and economy. This organization was originally known as the Fuller Electrical Company, which dates its existence from 1878. This system was the foundation of the well-known Gramme Association, being the party of the first part in the articles of association, which was composed of the Brush, Weston, United States, Thomson-Houston, Edison and Joblacoff companies, which was good evidence that all the companies composing that association were willing to pay tribute to the superior merit of the Fuller Wood system.—*N. Y. Sun, Sept. 27th*, 1885.

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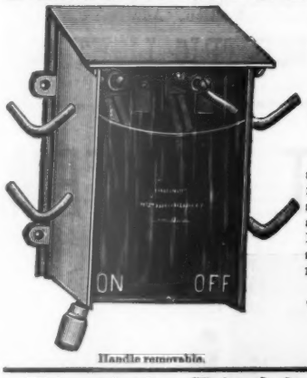

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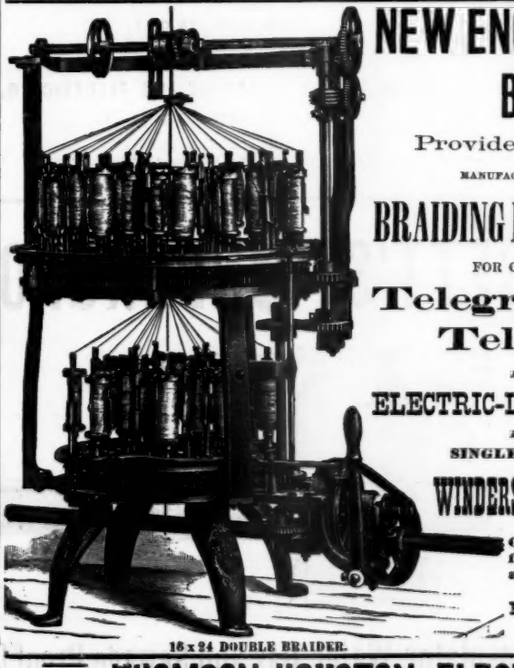

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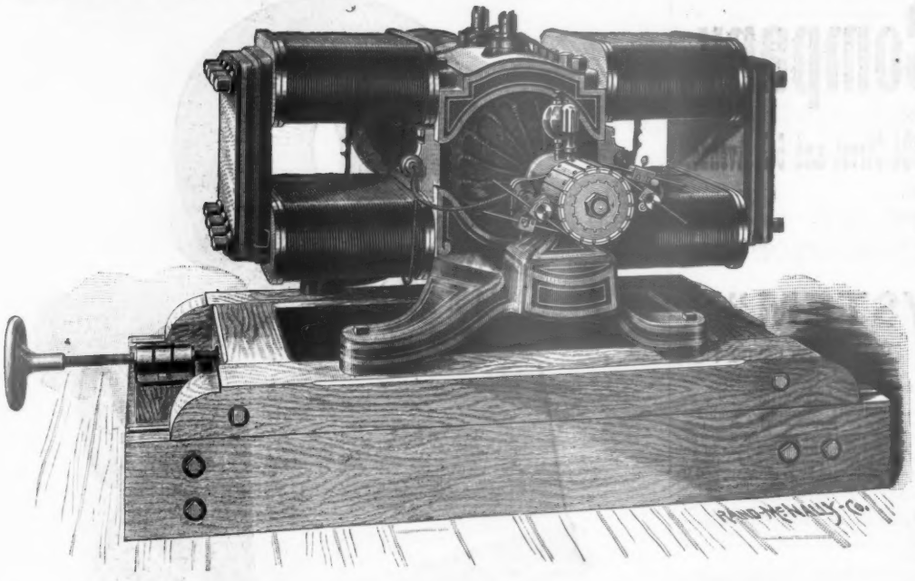

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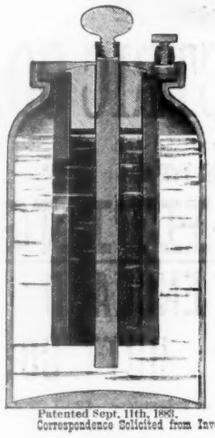

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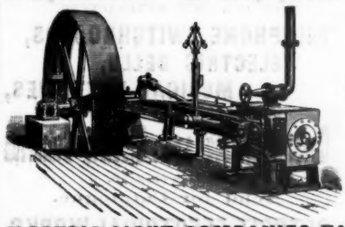

From 10 to 2000 Horse Power, with Harris's Improvements. These Engines are of
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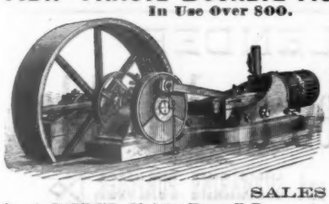

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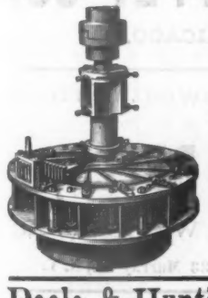

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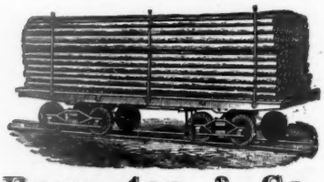

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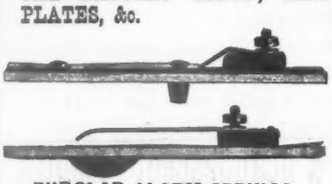

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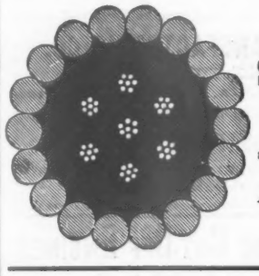

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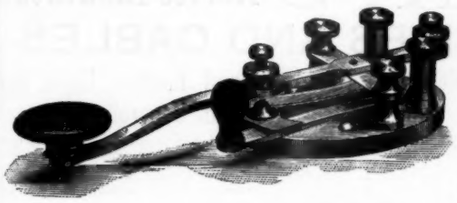

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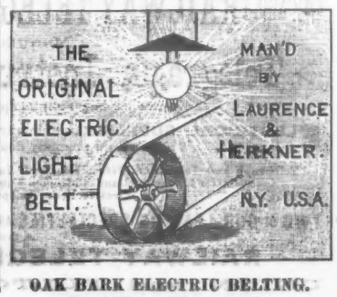

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